Computer Engineering Department
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LAB10: Image Enhancement in the Frequency Domain

Objectives

Upon completion of this lab, you will be able to:

1. Understand the mechanics of frequency filtering.
2. Explain the different types of frequency filtering.
3. Write a user-defined function in MATLAB to remove noise in an image using Butterworth lowpass filter and Gaussian lowpass filter**.**
4. Write a user-defined function in MATLAB for finding the edges of objects within the image using Butterworth highpass filter and Gaussian highpass filter**.**
5. Write a user-defined function in MATLAB to demonstrate wrap-around effects by using different methods, including Butterworth lowpass filter without zero-padding and Butterworth lowpass filter with zero-padding.

Exercises

Note that you should create your own function in MATLAB as MATLAB User-defined function. It means that you cannot call MATLAB built-in function, which generates output in the same manner as your own function. You can use the images provided in the folder **\Google Drive\EGCI486-Image Processing\Second(2015-2016)\LABs\LAB10** for your exercises.

1) Image enhancement in the frequency domain using Butterworth lowpass filter (Image smoothing)

   1.1 Consider the eight image corrupted by Gaussian noise. Write a user-defined function in MATLAB to filter the noisy version of the eight image using Butterworth lowpass filter with zero-padding. Take the following function name: Myblf.m. Using this program on the image "eight_g.tif" should give you result as shown in Figure 1.

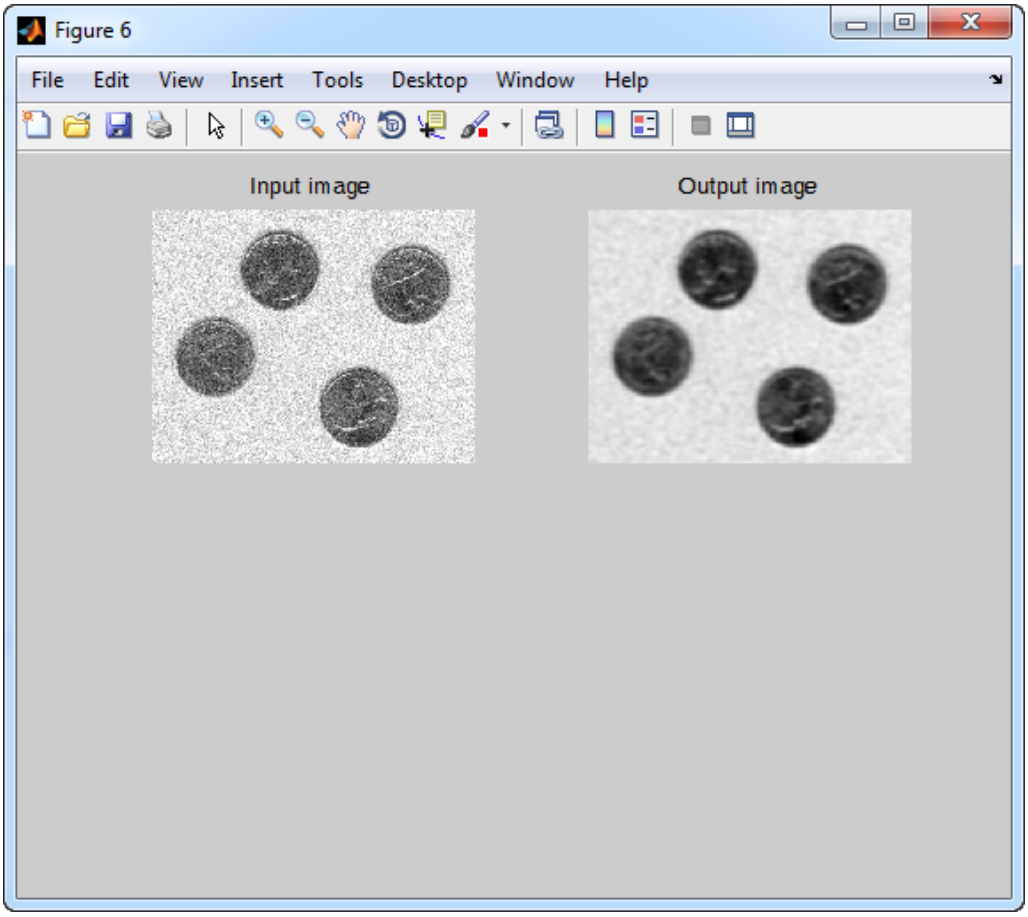

Figure 1: The result of applying the Butterworth lowpass filter on the noisy image (D_0 = 30, n = 2).

2) Image enhancement in the frequency domain using Gaussian lowpass filter (Image smoothing)

2.1 Write a user-defined function in MATLAB to filter the noisy version of the eight image using Gaussian lowpass filter with zero-padding. Take the following function name: Myglf.m. When this program is used with image "eight_g.tif" the result as shown in Figure 2.

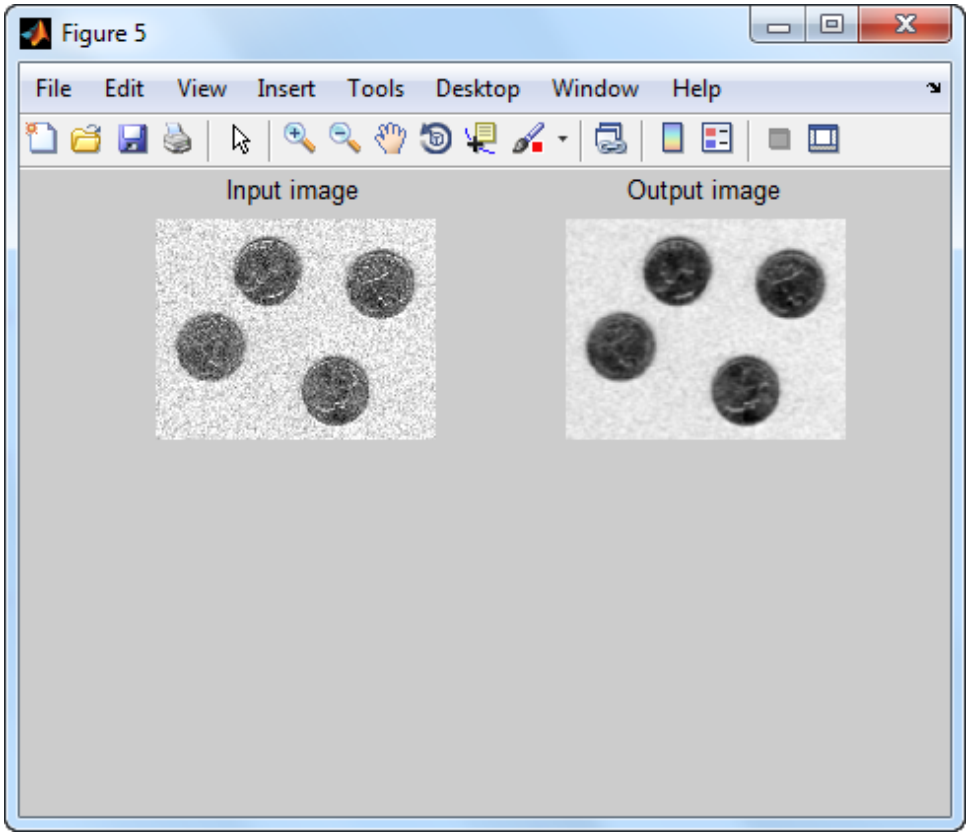

Figure 2: The result of applying the Gaussian lowpass filter on the noisy image ($D_0 = 30$).

3) Image enhancement in the frequency domain using Butterworth highpass filter (Image sharpening)

3.1 Write a user-defined function in MATLAB for finding the edges of objects within an image using Butterworth highpass filter with zero-padding. Take the following function name: Mybhf.m. Using this program on the image "aaa256.jpg" should give you result as shown in Figure 3.

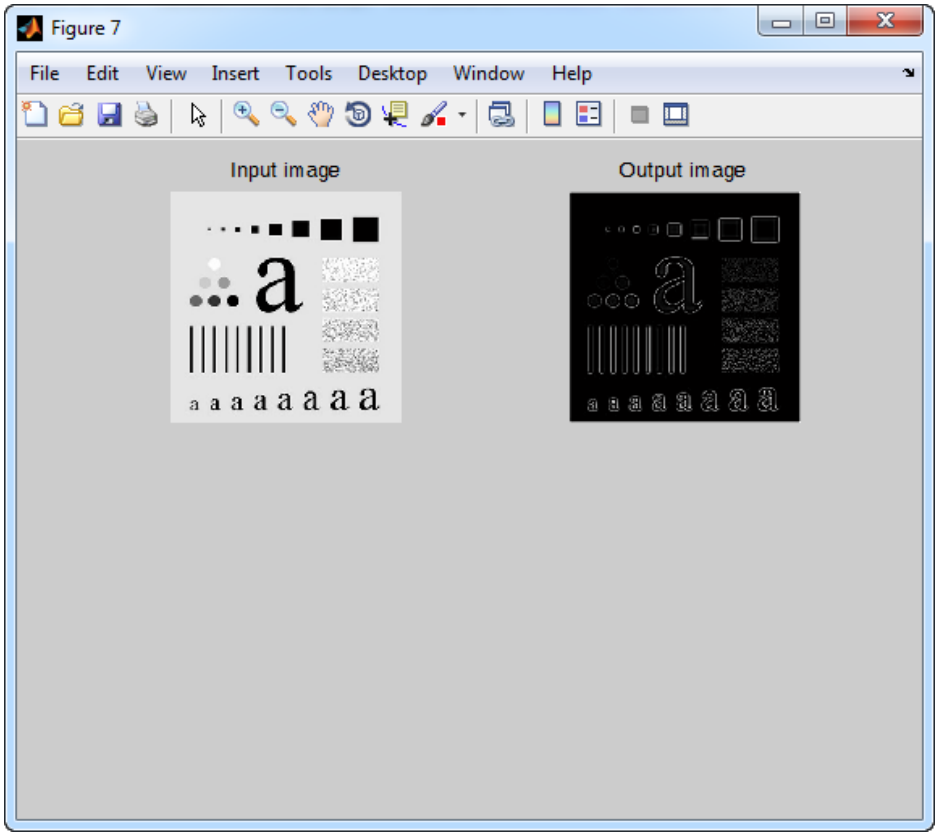

Figure 3: The result of applying the Butterworth highpass filter on the input image (D_0 = 80, n = 2).

4) Image enhancement in the frequency domain using Gaussian highpass filter (Image sharpening)

4.1 Write a user-defined function in MATLAB for finding the edges of objects within an image using Gaussian highpass filter with zero-padding. Take the following function name: Myghf.m. When this program is used with image "aaa256.jpg" the result as shown in Figure 4.

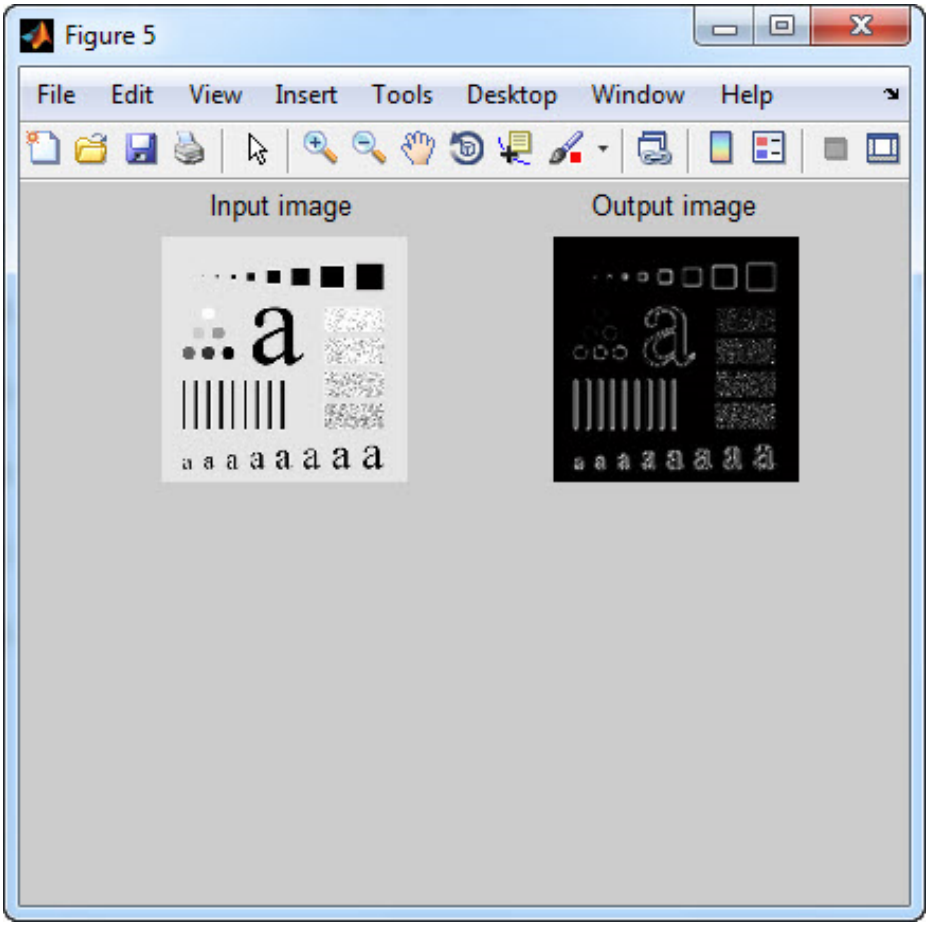

Figure 4: The result of applying the Gaussian highpass filter on the input image (D_0 = 80).

5) Compare between Butterworth lowpass filter without zero-padding and Butterworth lowpass filter with zero-padding

5.1 Write a user-defined function in MATLAB using Butterworth lowpass filter without zero-padding. Take the following function name: Myblf.m. When this program is used with image "square_original.tif" the result as shown in Figure 5.

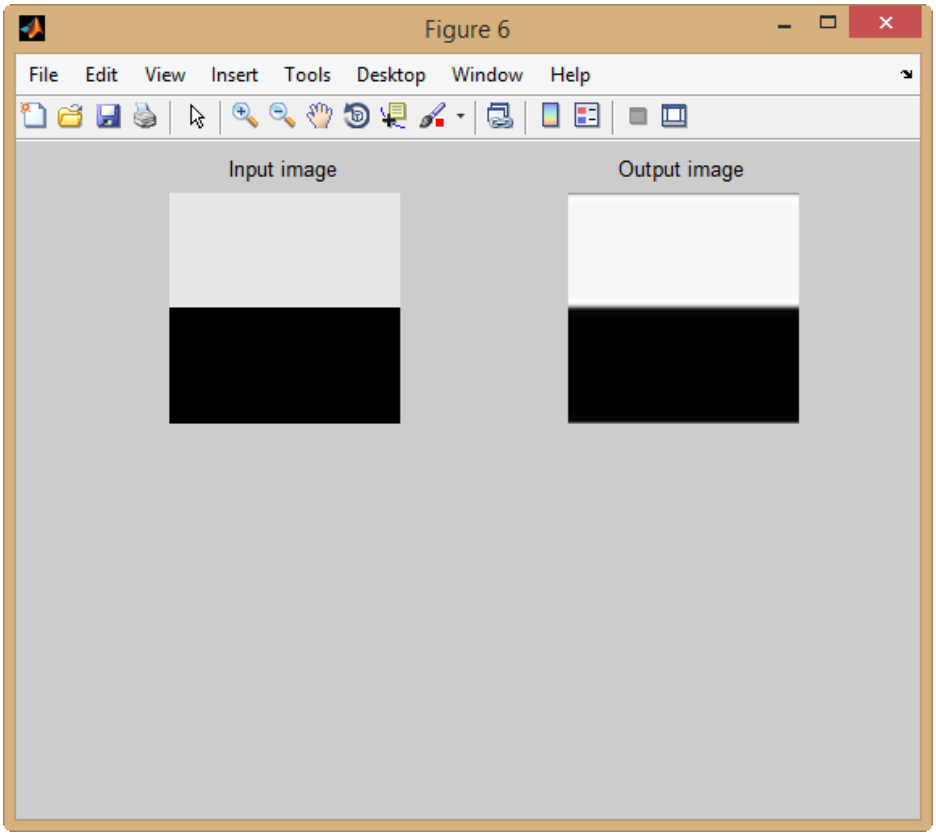

Figure 5: The result of applying the Butterworth lowpass filter without zero-padding (D_0 = 20, n = 2).

5.2 To avoid wrap-around effects, write a user-defined function in MATLAB using Butterworth lowpass filter with zero-padding. Take the following function name: Myblfpad.m. When this program is used with image "square_original.tif" the result as shown in Figure 6.

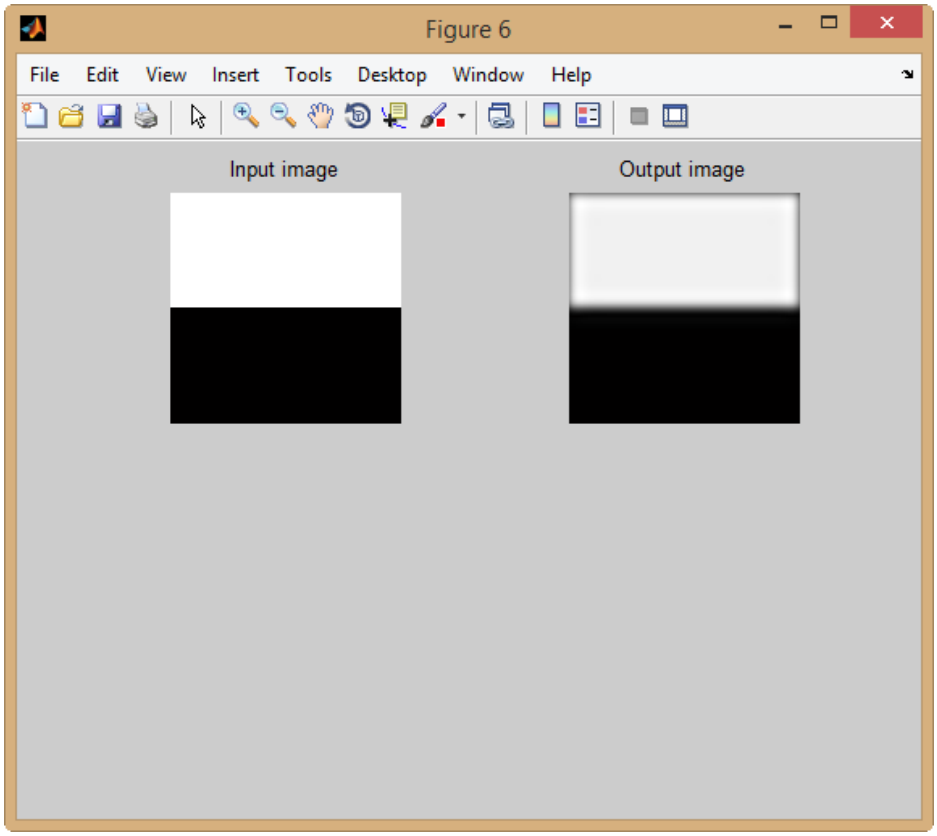

Figure 6: The result of applying the Butterworth lowpass filter with zero-padding (D_0 = 20, n = 2).